# PROGRESS REPORTS

FROM

# EXPERIMENT STATIONS

SEASON 1955-1956

## SURVEY AND SUMMARIES OF REPORTS

PUBLISHED BY

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## PROGRESS REPORTS FROM EXPERIMENT STATIONS. SEASON 1955-56

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A full list of the reports published for the season 1955-56 is given below; the price post free is 7/6d. for the set, or 9d. each for individual reports.

1. Cotton Research Station, Namulonge, Uganda.
2. Kenya.
3. Tanganyika—Lake Province.
4. „ —Eastern Province.
5. Nyasaland.
6. Northern Nigeria.
7. Republic of the Sudan.
8. Aden.
9. West Indies.
10. Survey and Summaries of Reports for 1955-56.

# SURVEY AND SUMMARIES OF PROGRESS REPORTS FOR THE SEASON 1955-56

BY

D. F. RUSTON.

## INTRODUCTION.

*Where the Staff Work.*

The overseas staff of the Corporation work in Uganda, Kenya, Tanganyika, Nyasaland, Northern Nigeria, the Sudan, Aden and the British West Indies, and by agreement with the Governments of these territories are responsible for their cotton breeding programmes and much of the other research on cotton growing.

At home, there is a Head Office in London, through which, with the help of the Scientific Advisory Committee and Consultants, contact is maintained with the scientific work of Universities and Research Institutes, and with the Shirley Institute of the British Cotton Industry Research Association, to which samples of cotton lint from all territories are sent for reports on their spinning and fibre qualities.

Of the overseas stations the only one owned and run by the Corporation is the Cotton Research Station at Namulonge in Uganda. At Serere, the other station in Uganda, and in all the other territories, Corporation staff work on Government Experiment Stations where houses, laboratory facilities and local staff are provided.

The climatic and general conditions in these territories cover a very wide range. In most, cotton growing depends entirely upon rainfall, but in the Sudan the major part of the crop is under gravity, pump or flood irrigation, and in Aden the whole cotton area is flood irrigated. The types of cotton grown also cover a wide range, from the 1″ American Upland type of Nigeria to the superfine 2″ staple type grown in St. Vincent in the West Indies—the longest and finest cotton in the world. The total value of the cotton crops of the territories in which Corporation staff are working has in recent years varied between £60 and £75 million a year.

*Objects of the Work.*

In general it could be said that the objects of the Corporation's work are to increase the yield per acre and to improve the quality of

the lint. This, however, is in many ways an over-simplification, and the fact that in many territories yields per acre have not increased in recent years does not mean that the work has failed. Indeed, in many cases it may be something of a major triumph to maintain the yield at the same level from year to year in the face of increasing attacks of pests and diseases, exhaustion of the soil and introduction of cotton growing into more marginal areas as production expands. For example, when the Corporation first sent staff to South Africa in the early 1920's, the cotton growing industry was dying out as a result of the insect pest, jassid. Through the efforts of Mr. F. R. Parnell, however, a hairy type of cotton known as U4 was evolved which was resistant to jassid, and which not only saved the South African industry but also forms the basis of much of the present cotton crop of the southern portion of Africa, including Portuguese and Belgian territories.

A further, and more recent, example is that of the Abyan area in Aden, where cotton growing started some 10 years ago. In the early seasons, when much of the land was being put under cultivation for the first time for many years, yields were very high. Recently, however, yields have been dropping from lack of rotation, exhaustion and salting of the soil, and the gradual build-up of pests and diseases. The task of the Corporation's staff is to combat all these influences, and to restore the yield as far as possible to its former level.

As an inter-territorial body, the Corporation is in a particularly favourable position to carry out this work, since ideas, staff and seed can be freely exchanged between territories. Research work by itself, however, will not lead to any general improvement, and it is only when the results of research are put into practice through the extension services of the Ministries and Departments of Agriculture that large increases in production, such as those of recent years, can be achieved.

## SURVEY OF THE SEASON 1955-56.

Production this season in the territories in which Corporation staff are working totalled nearly $1\frac{1}{4}$ million bales. Since the total amount of cotton used in the United Kingdom in 1955-56 was under $1\frac{3}{4}$ million bales, it can be seen that production in these territories was equivalent to nearly 70% of U.K. consumption. Although by no means all this cotton in fact came to the United Kingdom, the ample supply available does mean that the Lancashire cotton industry no longer need be dependent on the United States, and thus one of the objects for which the Corporation was formed has been successfully achieved.

*Plant Breeding.*

In practically all the territories covered by these reports some resistance to bacterial blight (*X. malvacearum*) and jassid is essential. Resistance to jassid is normally achieved by the plant breeder, by ensuring that the leaf is hairy. This in itself is not particularly difficult, but with the finer linted types of cotton, such as are grown in the Sudan, increasing the leaf hairiness often leads to a falling off in lint quality—a point which the plant breeder must be careful to guard against.

Resistance to bacterial blight is more complicated, since the disease has three main forms—the angular leaf spot phase, which commonly attacks the young leaves, the blackarm phase, which attacks the stems and branches, and the bacterial bollrot phase, which attacks the bolls. Types which are resistant to one phase of the disease may not be resistant to the others, and hence local testing and selection are needed.

Although these, and general selection for yield, are the main problems, the plant breeders are also concerned with work to increase lint strength (crosses with Hopi Acala, etc.), the retention of lint in the boll (stormproof types), and with resistance to leafcurl in the Sudan, to wilt in Aden and with tolerance to salt accumulated in the soil.

Multiline strains, which are mixtures of closely related lines, have been used on an increasing scale in recent years, partly to even out minor defects in single lines, and partly to make the strains adaptable to a wider range of climatic and soil conditions. Examples of these multiline strains are the successive waves developed at Ukiriguru (Uk46, 48, 51, 53 and 55), which now cover the whole of the Lake Province of Tanganyika; BPQ, the high strength, good quality cotton now being multiplied in Uganda; and 26J, which will gradually replace 26C in the next few years in Northern Nigeria. However, this season's Namulonge report brings out another approach to the problem, by suggesting that some single lines may now be able to give better results than the multiline mixtures. If such single line selections are successful, it may be that they will, in their turn, replace the multiline strains.

*Plant Pathology.*

The plant pathologists work in very close co-operation with the plant breeders, and it is largely owing to their success in developing accurate and rapid inoculation techniques that so much progress has been made in breeding selections resistant to bacterial blight. This disease is, however, also being kept in hand by other methods, such as seed treatment, which is now being adopted on a large scale in most

territories. Seed treatment reduces the early attack by bacterial blight, although it does not appear to control the later development of the disease. The pathologists are testing many kinds of seed treatment, and this work is considerably helped by the close co-operation which exists between the territories.

*Verticillium* wilt disease is also under investigation, and the senior pathologist at Namulonge recently visited Aden to investigate an outbreak there of a root rot which has not yet been identified.

*Entomology.*

One of the chief problems of the entomologists is to make an accurate estimate of the amount of loss caused by insect pests. As the cotton plant normally produces far more bolls than it can carry, up to two-thirds of the flowering points would probably be shed in any case. In some cases, therefore, even though the early crop may be almost completely destroyed by pests it may still be possible to obtain a good yield through the setting of the late crop. It has been estimated that one fully formed boll per stand will give roughly 70 lb. seed cotton per acre. It is, therefore, possible to have a reasonable yield with a comparatively small number of bolls per plant.

Another difficulty which concerns the entomologist is that of conducting controlled experiments with insecticides, as it is impossible to control insects on one plot completely without some effect on neighbouring plots. There is also the additional difficulty that where one pest is controlled by insecticides this may lead to an increase in others; for example, spraying against jassid in the Sudan is thought to have led to an increase in the number of whitefly.

In Uganda the chief pest is probably *Lygus,* but at Namulonge the loss is not serious with early sown cotton, as the longer season makes recovery possible. With late sown cotton, however, *Lygus* damage can be very considerable.

In the Eastern Province of Tanganyika the major pest is American bollworm, and in many areas dusting or spraying is essential if any crop at all is to be reaped. In the Lake Province of Tanganyika, where production has increased very considerably in recent years, American bollworm can cause severe damage. In these areas the bollworm is probably bred on early planted maize and sorghum.

In Nigeria red bollworm is the chief pest but, as in Uganda, the loss of crop caused by insect pests seems to depend very largely on the season. With late planted cotton, or in seasons when the rains finish early, as in 1955-56, the damage can be considerable. Insecticide trials in Nigeria have shown good results where pest attack is heavy but, as in other areas, it is evident that the application of insecticides

in either dust or spray form is quite uneconomic unless the crop is capable of giving a good yield in the absence of pests. This implies early planting, early thinning and early cleaning.

*Crop Husbandry.*

Crop husbandry covers a variety of subjects—rotations, fertilisers, spacing, time of planting, etc. In all areas it seems evident that time of planting is the most important point, and a delay of even a few weeks can make a big difference to the ultimate yield. One of the factors responsible for the better yields from early planting appears to be moisture. In Nigeria, for example, in many seasons the land is waterlogged in August and September, and yet by the middle of October, when the rains have ceased and the harmattan wind has started, conditions have changed rapidly and growth ceases suddenly. Cotton planted at the beginning of July thus has at least 3 months' good rain to get established, whereas cotton planted at the end of August has only one month.

At Namulonge this season, preliminary trials were carried out to study the effect on the plant of additional supplies of water. By this means the onset of water stress was delayed by about one month, thus allowing bolls to mature which would otherwise have shrivelled and died, and increasing the yield by nearly 50%.

As would be expected, the value of fertilisers and the effect of spacing varies considerably from place to place. In Aden, for example, signs of nitrogen deficiency have become evident in the last few years, and this last season applications of 500 lb. sulphate of ammonia per acre led to increases of 50%. It is also possible that higher yields may be obtained in Aden with slightly closer spacing, the current spacing of 1 metre by 1 metre having been adopted in the early days when large plants with much vegetation were produced on soil which had not been cultivated for many years.

Extracts are given below from the reports from the Lake and Eastern Provinces of Tanganyika which give typical examples of current recommendations for the guidance of cultivators.

*Lake Province.*—"Use to the full any cattle manure available, with the knowledge that responses will continue for a considerable number of years. If cattle manure is not available, apply 100 lb. per acre superphosphate, again in the knowledge that residual responses will persist for a number of years. In addition, top dress annually with 100 lb. per acre sulphate of ammonia. Any land resting that is possible is equivalent to a dressing of cattle manure in direct and residual responses".

*Eastern Province.*—"The best methods of cotton cultivation in the Eastern Province are now reasonably clear cut. Recommendations

are: February planting with a jassid resistant variety, treated weekly with 10 lb. DDT/BHC dust or equivalent spray during the insect attack in April, May or June; spacing at 1 ft. between plants, 1 plant per hole, rows 3 ft. apart".

## SUMMARIES OF THE 1955-56 REPORTS.

### Cotton Research Station, Namulonge, Uganda.

Early planting again gave the highest yields, and 3 ft. by 1 ft. was in general the best spacing, giving a 20% increase over 3 ft. by 2 ft. The results of fertiliser trials were mixed; fertilisers may be needed later on, when the soil has been cropped heavily for a longer period. Phosphate promotes early production of cotton.

The main conclusions drawn from the three year insecticide and crop loss trial were as follows. *Lygus* is not responsible for serious loss in early sown cotton, as the long season makes recovery possible, but it can cause loss in late sown cotton. There is some bollworm damage, but the losses are not large enough to justify further investigation into the economics of control measures; insecticides can reduce shedding caused by bollworm, but the total number of sheds is not reduced. As differences between localities are greater than between treatments, the studies are to be repeated over as wide an area as possible.

The season was unfavourable to the development of bacterial blight at Namulonge. Experimental inoculation of seed and spraying of leaves with *X. malvacearum* had no adverse effect on yield. Other experiments showed a strong tendency for both stem and boll infections to occur on plants which had shown early leaf infection. A large number of strains were tested for susceptibility or resistance to the leaf, stem and boll forms of the disease.

Continued selection in BP52 over a number of years has led to a yield increase of 20%, and to a rise in mean maximum halo length from 30·3 mm. to 34·9 mm. in six seasons. The first of the multiline strains, NC54, has reached the first stage of seed multiplication, and two others, NC55 and the quality selection NC55/Q (or BPQ), have been issued. Multiline strains have been used to even out minor defects, but as it appears that these can now be eliminated by breeding methods, the issue of single line strains may be more advantageous in future.

Breeding will henceforward concentrate on the production of the best cottons for good farming conditions, since the agricultural practices which will ensure good crops are now well known.

The crossing programme has been continued to combine the bacterial blight resistance of Albar with the jassid resistance and lint quality of the UP strains (MU8 × BP52), the resultant strains being known as UPA. Some of these will be tested in the Eastern and Northern Provinces, where jassid attack may be more severe than in the BP52 area.

A yield trial was carried out to compare all breeding stocks available at Namulonge (49 strains). Differences between the group mean yields (BP52, Albar, UP, etc.) were not statistically significant, but there were large differences in variability between strains within groups. The BP52 group was fairly uniform, whereas in the Albar group yields ranged from 175 to 425 lb. lint per acre. The best Albars significantly outyielded the best BP52 strains.

Routine lint quality testing continued.

## Kenya.

*Nyanza Province.*

Bacterial blight caused considerable damage during the season, the boll lesion and blackarm phases being common. The weather was favourable to the spread of infection and the seed dressing used was not as effective as it might have been. Some *Verticillium* wilt was recorded, for the first time.

Time of planting trials gave results very similar to those of previous years. Yields from March and April planting were over 1,100 lb. seed cotton per acre, falling to 438 lb. in May and to 273 lb. in June.

Inter-cropping trials with maize were carried out to see whether early planting could be obtained without upsetting the normal food crop acreage. Reasonable results were obtained, particularly where the cotton and maize were grown on tied ridges which help to conserve water.

A pest assessment trial was carried out at Kibos. This showed that losses due to pests causing shedding of buds and bolls (*Lygus, Heliothis,* etc.) amounted to approximately 19%, losses due to pests carrying *Nematospora* (*Dysdercus,* etc.) 32%, and losses due to pests of large bolls 6%. These figures all assume optimum control of the other two groups of pests and are not additive.

Dusting trials (10% DDT plus 3% BHC) were carried out at numerous centres, and in nearly all cases useful yield increases were obtained. Sodium arsenite/sugar bait was found to give good control of stainers.

*Coast Province.*

The exceedingly low Provincial average yield of just under 40 lb. lint per acre probably results from the fact that nearly all the cotton was inter-planted with maize.

N17 was the main variety grown, with small areas of S47. Jassid and stainers were the main pests, N17 being particularly susceptible to jassid damage. Variety trials showed that Uk48 was a promising variety, with reasonable resistance to jassid.

### Tanganyika — Lake Province.

The season was climatically almost ideal for cotton growing, but the mean Provincial yield of 144 lb. lint per acre was only about the same as in 1954-55, as a result of very heavy bollworm attacks. Perecot dressing of all planting seed seemed to keep blackarm in hand in a year when a bad attack might have been expected, but many areas suffered from bacterial bollrot. The marginal areas were unsuccessful, mainly because of pests, and insecticide spraying is to be started there in 1956-57.

Recommendations can now safely be made for the hill sand areas as follows. Full use of cattle manure, or failing that 100 lb./acre double superphosphate, both of which give responses continuing for years. In addition, yearly top dressing with sulphate of ammonia at flowering. Land resting equals cattle manure in direct and residual responses.

Time of planting is one of the most important factors in productivity; too early planting results in boll-opening in the rains, and planting in late November and December is recommended.

In a trial at Ukiriguru, cotton (but not millet) gave a small but significant response to ridge tying. There were no significant differences between 3 ft., 4 ft., and 5 ft. tied ridges in another trial.

Uk51 covered the whole province this season, except for Uk55 multiplication in Kome Island (which yielded 49 tons of seed for planting in 1956-57). Seed cotton yields reached 1,350 lb. per acre in the main strain trial, despite American bollworm; there was no difference between Uk51 from Ukiriguru seed and commercial seed stocks. Uk55 appears likely to have a higher ginning outturn and lint index than Uk51.

In 1955-56 there was widespread and serious bacterial bollrot, which had not in general caused severe losses in the previous three seasons. Seed treatment seems to offer little protection against this phase. New techniques for large scale boll inoculation are being developed in collaboration with Namulonge. Some Albar 51 backcrosses with the best Ukiriguru strains yielded 20% more than Uk51, and some second backcrosses with BAR 14/38 ($B_2B_{6m}$) showed high jassid resistance and

markedly improved plant habit. Local strains are also being tested for stem resistance.

Mercurial seed treatments were consistently better than copper. Formulations incorporating dyes are being tested, though the large scale use of mercurials is not envisaged immediately; investigations are needed into dangers of poisoning in dusting sheds. Observation plots and replicated trials showed no consistent yield increases from dressing, despite spectacular differences in appearance in the first 3 or 4 months of growth.

There were sporadic recurrences of *Fusarium* in some areas of Geita district; the localities have been sealed off from seed multiplication areas, and sites have been chosen for tests of imported wilt resistant varieties in 1956-57.

American bollworm damage was very serious throughout the province. The entire crop was lost in the Ukiriguru "mbuga" strain trial. Here the bollworm was believed to have bred up on early sorghum, and steps are to be taken in 1956-57 to prevent invasion of cotton from sorghum and vice versa. In the commercial crop, bollworm is thought to have invaded cotton from early maize, of which the area was greater than usual owing to good early rains. *Lygus* was crippling in one late planted trial at Ukiriguru, where it was attributed to movement from early sorghum.

Investigations have started into soil moisture, nitrate, and the effects of land resting and organic manures on supply of nutrients.

### Tanganyika — Eastern Province.

The new strain, 47/10, will replace Local over the whole of the Province for the 1957 season. With the earlier (February) planting now recommended, jassid attack is greater than before and as 47/10 is susceptible to this insect resistant types are being sought. As an interim measure, several of the more jassid resistant strains will be bulked as a multiline issue for testing in district plots.

Preliminary trials of local and imported varieties are being carried out for testing under irrigation in the Kilombero valley.

The main pest in the Eastern Province is American bollworm, and in many areas, particularly around Ilonga, insecticidal control is essential if any crop at all is to be harvested. General recommendations at present are for the application of a dust (1 lb. DDT plus 0·3 lb. BHC per acre per application) at weekly intervals during the months of May and June. In trials on the Ilonga station, greater increases have been obtained from applications of spray instead of dust, but spraying is more expensive and complicated and it would probably require a contract team to carry it out successfully on a commercial scale. Dusts, on the other hand, can be applied by individual growers with a locally made Swaine duster costing only about 10/-.

### Nyasaland.

The combination of reduced acreage, red bollworm, stainer and bacterial blight resulted in a very poor crop this season.

Over the past few years CL20 has shown consistent superiority over CLB in staple length and spinning quality, and as it also has a shorter and more compact habit, it will be grown throughout the Central and Southern Provinces in 1957-1958.

The testing and multiplication of Albar 51 derivatives continued, and some of the strains showed particular promise, giving yield increases of 25% to 48% over CLB. These have good resistance to bacterial blight and are expected to become the standard variety in Nyasaland in a few years.

During the season, Mr. E. O. Pearson, formerly the Corporation's Senior Entomologist and now Assistant Director of the Commonwealth Institute of Entomology, visited Nyasaland and Southern Rhodesia. He found that the new regime of early planting and early uprooting was giving sufficient control of red bollworm in the Lower River to permit the setting of a large potential crop, but he advocated the early digging or ploughing of old cotton fields to destroy long term pupae, and the investigation of control by chemicals, such as DDT and BHC, Parathion or Endrin which had given good results in trials in Southern Rhodesia. He also found that in the last few years damage by stainers had increased. He suggested that an entomologist should be appointed to investigate the sequence of breeding on wild host plants, the possibility of breaking that sequence by eradication of one or more of the tree hosts or of the stainer populations on them, and the practicability of direct control of stainers on cotton by the use of insecticides.

### Northern Nigeria.

The crop was considerably less than had been expected, as excessive rain in August and September led to waterlogging, and this was followed by the early onset of the harmattan and the shutting down of the crop. Where cotton was planted early, reasonable yields were obtained, but late plantings incurred heavier penalties than usual.

Although the incidence of pests and diseases seemed to be no higher than usual, they caused more damage than in a normal season, as the early closing down prevented the formation of a compensating later crop.

The conditions of growth did not affect all varieties in the same way, and strain trials in some cases showed results in conflict with earlier seasons. Even so, however, it is clear that the 26C/479 derivatives, either alone or combined as 26J, give higher yields than control 26C.

Multiplication of 26J has been carried out at an increased rate, and 39 tons of the seed are available for planting in 1956-57.

Significant differences in plant characters were brought out in progeny row tests, and lint per seed appeared to be the most influential single character; bolls per plant were of more importance than seeds per boll.

The hybridisation programme was continued, the purpose of the crosses being to combine lint quality (BP52) with early cropping and high yield (MU8), high ginning percentage (26I) and resistance to bacterial blight (Albar 474).

Experimental seed treatment with the mercury dressing Agrosan GN5 led to a striking reduction in the number of blackarm infected plants in the early stages, but, as usual, this difference was gradually obscured later by the secondary spread of the disease. In final yields, however, the treated plants gave a 15% increase over the untreated.

Early July was again shown to be the best planting date, irrespective of whether the fertility of the soil was high or low. Applications of nitrogen and phosphorus gave increases of 20% to 25%.

Red bollworm was the main pest, but there was evidence that pink bollworm could be serious in areas where the close season was not adequately enforced. Spiny bollworm and false codling moth appeared to be causing increased damage in the southern parts of the cotton belt, and stainer damage was again severe at Mokwa.

Insecticide trials at Samaru showed significant differences, a DDT/BHC spray giving a 50% yield increase. The effect of insecticides appears to have been much greater this year than usual, again in all probability owing to the short season.

In a time of planting, manurial, spacing and spraying trial at Kontagora the most significant result was obtained from the use of sprays, the average yield from all spray treatments being 370 lb. seed cotton per acre compared with 61 lb. from unsprayed. No differences were obtained from spacings of 9, 18 and 27 inches. The time of planting and manurial results were as expected.

### Republic of the Sudan.

In spite of the big drop in the acreage under American type raingrown cotton and the complete failure of the Tokar flood, the total crop was the largest ever produced. Grade, however, was poor. Whitefly damage was considerable, blackarm was bad on susceptible strains, and the crop closed down very early.

BLR 14/25 (S type) has now been accepted as a commercial type (5,000 acres to be grown next season) and attempts are being made to increase its yield as, *in the absence of blackarm,* its lint yield is below that of Sakel, which has a higher ginning outturn.

The expansion of BAR XL1 (L type) has been remarkable, over 166,000 acres being grown. Efforts are being made to increase the blackarm resistance of this strain and also to increase leafcurl resistance in the Sakel types.

In variety trials, in a year when blackarm was severe, BLR 14/25 outyielded Sakel by 10% (lint) while BAR XL1 and BAR XL3 gave lint increases of 7% and 9% over X1730A.

Two high strength American types were tested—Hopi Acala and Acala 4.4.2. The latter was particularly impressive, giving over 1,200 lb. seed cotton per acre with a ginning outturn of over 40%. Two other strains from America, Pima S1 and Pima 32, yielded well and were extremely early. They may be useful as parents to transfer "earliness" to commercial types.

Work continued at Medani and Shambat on the production of strains tolerant to salt, and on the transference of the following characters: (a) lint retention from *G. contextum* and Stormmaster; (b) jassid resistance to commercial strains; (c) bollworm resistance from *G. thurberi*; (d) high lint strength from *G. thurberi*; (e) 4 and 5 loc bolls from *G. hirsutum,* to increase yield.

At Kadugli, rainfall was much below average and sowing was generally delayed. Pests (flea beetle, leaf roller, stainer and Sudan bollworm) were widespread in the Nuba Mountains but variable in severity of attack. *Ramularia* disease continued to increase and caused more damage than blackarm in certain areas.

The following table summarises the results of variety trials carried out in Kordofan in recent years. Figures are given as percentages of BAR SP84.

| | *Lint Yield.* | *C × S at 40's.* |
|---|---|---|
| Pump Scheme Strain ..... | 95 | 101 |
| BAR 7/3 ..... | 105 | 97 |
| BAR 7/8.1 ..... | 127 | 87 |
| BAR 7/8.2 ..... | 132 | 83 |
| BAR 11/7 ..... | 109 | 116 |

### Aden.

A record crop of nearly 32,000 bales was produced, of which approximately 18,000 came from the Abyan Delta, 10,000 from Lahej, 1,000 from Yeramis and 3,000 from other areas.

The Sudan strain BAR XL1 has proved promising, both as regards yield and quality, and selection on this and other strains is being continued. The aim is to produce a commercial crop of full $1\frac{1}{2}''$ staple with a greater degree of regularity than at present.

Wilt has increased considerably in the last two years, especially in the northern half of the Delta. It is believed to be *Rhizoctonia*, associated with soil conditions arising from a high water table. Lack of rotation helps the disease to spread. Sakel and Karnak types are particularly susceptible, but Wild's Early has a high degree of resistance and is being used in crosses.

Over much of the area there are now signs of nitrogen deficiency and the application of 500 lb. per acre sulphate of ammonia gave a 50% yield increase. It is also probable that the present spacing of 1 metre by 1 metre, adopted to cope with the luxuriant growth in the first few years, could now be reduced. Trials will be carried out next season.

Soil and irrigation water surveys have been started and the extent and depth of the impermeable clay layer have been defined. The layer varies from 3 ins. to 2 ft. in thickness and occurs at a depth of 10 ft. to 15 ft.

Saline fields have been shown to have a higher water table and a markedly lower bicarbonate content, probably because of destruction of bicarbonate by evaporation.

There appear to be two types of soil deterioration. In the first type excessive irrigation water is applied, leading to high evaporation and a build-up of salt. In this case evaporation is not continuous, as it stops when the water table is lowered, so that deterioration is normally slow. In the second type, the high water table is caused by seepage from other areas or poor drainage. In this case evaporation is almost continuous and deterioration is rapid.

It is suggested that the aim should be reduce the amount of water applied by irrigation so as to keep the water table below 10 ft. and thus reduce evaporation to a minimum.

Collections of insect pests were made during the season. Many pests were found, but so far they have only appeared in tolerable numbers, and there appears to be a well balanced predator/prey relationship. Notable damage occurred only in small areas.

## West Indies.

Production of Clean Lint—Sea Island Cotton.

| | *Bales of 400 lb.* | | *Yield lb. lint per acre* | |
|---|---|---|---|---|
| | *1955-56* | *1954-55* | *1955-56* | *1954-55* |
| Antigua | 2,836 | 3,022 | 190 | 230 |
| Nevis | 1,437 | 1,154 | 165 | 153 |
| Montserrat | 647 | 942 | 103 | 128 |
| St. Kitts | 139 | 228 | 119 | 160 |
| St. Vincent | 379 | 510 | 126 | 84 |
| Total | 5,438 | 5,856 | 160 | 166 |

Yields showed a considerable drop in Antigua, Montserrat and St. Kitts owing to unfavourable weather, leafworm and pink bollworm.

Manurial trials in Antigua did not show the usual response to nitrogen, probably owing to the very dry close season. Phosphate, however, again increased the yield, particularly when combined with acid treatment of the seed which led to better germination and early growth.

Previous results have suggested that on deep, fertile soils a plant population of 10-12,000 per acre gave the best results. With the introduction of VH8, with its single stalk habit, and the spread of cotton growing to shallow and less fertile soils, trials were repeated. Again a plant population of about 11,000 proved as good as any, but on shallow soils, whilst doubling the population did not increase the yield, leaving one plant per hole instead of two gave a significant increase. In other words, a spacing of 4 ft. by 1 ft. with one plant per hole was preferable to a spacing of 4 ft. by 2 ft. with two plants per hole.

In St. Vincent the V135 variety was maintained, and in view of the fairly widespread occurrence of wilt (*Fusarium vasinfectum*), trials were carried out on fields known to be badly infected. Wide differences were noted, with MSI easily the most resistant, 86% of the plants being free from obvious wilt at the end of the season in comparison with 13% for St. Vincent V135. Selfed bolls from wilt free plants of each variety were harvested for use in a similar trial in 1956-57.

Although some strains of MSI were shown to give better yields than the commercial strain, the quality premium possessed by VH10, and the possibility of further increases in yield through selection, make it a suitable replacement for MSI in Antigua and Nevis.

The imported varieties, BAR XL1 from the Sudan and Seabrook from U.S.A., yielded well in trials in Antigua.

Pink bollworm attack was severe, particularly on estates, where mechanical uprooting apparently destroyed fewer larvae than the manual uprooting practised by the peasants. Leafworm was also serious, but this pest can be controlled by lead arsenate or the newer insecticides if treated at an early stage.

Bacterial blight damaged the young crop in most islands, particularly where the insect pest *Prodenia* was present. Acid treatment of the planting seed, where tried, gave almost complete protection from the disease and assisted early growth.

# COTTON PRODUCTION (in bales of 400 lb.)

**In Territories in which Corporation Staff are Working**

| | *Record Crops* | | *Recent Crops* | | |
|---|---|---|---|---|---|
| | *Season* | *Amount* | *1953-54* | *1954-55* | *1955-56* |
| Uganda | 1937-38 | 417,179 | 397,631 | 299,935 | 363,675 |
| Kenya | 1936-37 | 22,166 | 17,027 | 12,963 | 16,297 |
| Tanganyika | 1955-56 | *132,110* | 102,638 | 122,058 | *132,110* |
| Nyasaland | 1934-35 | 21,006 | 11,308 | 15,407 | 5,152 |
| Nigeria* | 1954-55 | 187,741 | 143,169 | 187,741 | 154,436 |
| Sudan | 1955-56 | 528,344 | 498,482 | 486,063 | 528,344 |
| Aden | 1955-56 | 30,700 | 21,736 | 22,140 | 30,700 |
| West Indies | 1940-41 | 9,312 | 3,766 | 6,377 | 5,457 |
| Total | 1955-56 | *1,236,171* | 1,195,757 | 1,152,684 | *1,236,171* |

*5-Year Averages.*

| | *1921-22 to 1925-26* | *1926-27 to 1930-31* | *1931-32 to 1935-36* | *1936-37 to 1940-41* | *1941-42 to 1945-46* | *1946-47 to 1950-51* | *1951-52 to 1955-56* |
|---|---|---|---|---|---|---|---|
| Uganda | 128,300 | 159,100 | 271,700 | 345,000 | 208,300 | 295,800 | 352,300 |
| Kenya | 1,500 | 1,300 | 7,400 | 15,600 | 6,800 | 8,300 | 14,400 |
| Tanganyika | 16,600 | 22,200 | 42,700 | 61,700 | 39,100 | 48,400 | 97,000 |
| Nyasaland | 5,800 | 5,300 | 11,200 | 9,600 | 9,100 | 8,100 | 12,000 |
| Nigeria* | 28,900 | 28,600 | 35,500 | 45,400 | 29,100 | 49,100 | 138,900 |
| Sudan | 53,200 | 142,700 | 214,800 | 321,500 | 297,700 | 357,200 | 460,400 |
| Aden | — | — | — | — | — | 3,800 | 18,400 |
| West Indies | 4,800 | 5,200 | 3,600 | 6,800 | 4,800 | 4,900 | 5,100 |
| Total | 239,100 | 364,400 | 586,900 | 805,600 | 594,900 | 775,600 | 1,098,500 |

*Exports only.

Figures in italics are estimates.

## COTTON PLANTING AND PICKING DATES

| | *Planting* | *Picking* |
|---|---|---|
| Uganda | June-August | December-March |
| Kenya | May-August | December-February |
| Tanganyika: | | |
| Lake Province | November-January | April-August |
| Eastern Province | February-April | July-October |
| Nyasaland: | | |
| Southern and Central Provinces | December-January | June-July |
| Northern Province | May-June | November-December |
| Northern Nigeria | June-August | November-February |
| Sudan: | | |
| Irrigated | August-September | January-May |
| Raingrown | June-August | October-February |
| Aden | August-October | February-May |
| West Indies | August-October | January-April |

## YIELDS OF LINT PER ACRE

The figures shown below have been included to give some idea of the yields obtained from cotton grown in different territories and under different conditions.

When looking at the figures it should be borne in mind that in most territories in Africa cotton is grown by peasant cultivators on small and scattered holdings, and is sometimes interplanted with other crops. In these circumstances accurate estimates of the area planted to cotton are difficult to obtain, and this naturally makes it difficult to arrive at the true yield per acre.

YIELDS OF LINT IN POUNDS PER ACRE.

| | *Type* | *1951-2* | *1952-3* | *1953-4* | *1954-5* | *1955-6* |
|---|---|---|---|---|---|---|
| Uganda | 1 | 100 | 86 | 98 | 69 | 91 |
| Kenya (Nyanza) | 1 | 93 | 53 | 56 | 60 | 62 |
| Tanganyika (Lake) | 1 | 169 | 168 | 167 | 142 | 143 |
| Nyasaland | 1 | 111 | 103 | 97 | 110 | 51 |
| Sudan: | | | | | | |
| Gêzira | 3 | 313 | 474 | 536 | 440 | 469 |
| Gash and Tokar | 2 | 122 | 144 | 125 | 125 | 248 |
| American | 1 | 127 | 111 | 118 | 112 | 132 |
| Aden | 2 | 294 | 363 | 395 | 276 | 409 |
| West Indies | 1 | 147 | 152 | 127 | 176 | 195 |

(1) Raingrown. (2) Flood irrigated. (3) Gravity irrigated.

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| ,, ,, ... ... ... ... | B. J. S. Lee, B.Sc. |
| Entomology ... ... ... ... | M. A. Choyce, B.Sc., D.I.C. |
| ,, ... ... ... ... | M. G. Emsley, B.Sc. |
| Plant Pathology ... ... ... | H. M. Parker, B.Sc. |

GOMBE, BAUCHI PROVINCE

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| Seed Multiplication ... ... ... | A. M. Krzywon, M.A. |

## REPUBLIC OF THE SUDAN

WAD MEDANI, GEZIRA

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| ,, ,, ... ... ... ... | A. Low, B.Sc. |

SHAMBAT, KHARTOUM

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| ,, ... ... ... ... | J. H. Saunders, B.Sc. |

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RESEARCH SECTION, EL KOD

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| Soil Science ... ... ... ... | J. E. A. Ogborn, A.R.I.C. |
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